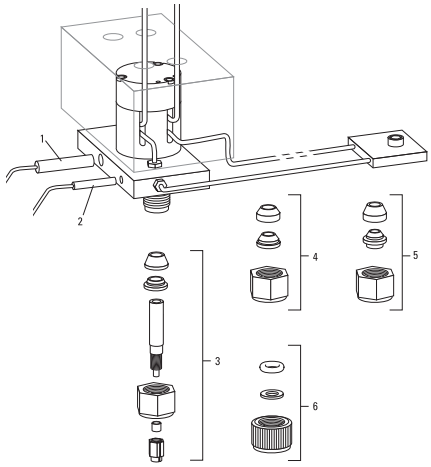
Thermal Conductivity Detector (TCD), TRACE GC Ultra and FOCUS GC

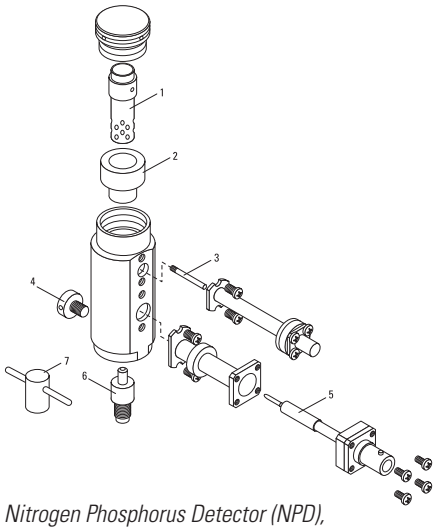
Item	Description	Cat. No.	Quantity
1	Adapter for capillary column (Kit)	**34709542**	1
2	Retaining nut for 6mm OD metal column and ferrule	**35020117**	1
3	Brass front/back ferrule for 1/8in. OD metal column	**29004666**	1
4	Retaining nut for 1/8in. OD column and ferrule	**35003062**	1



Thermal Conductivity Detector (TCD), TRACE GC Ultra and FOCUS GC

Nitrogen Phosphorus Detector (NPD), TRACE GC Ultra

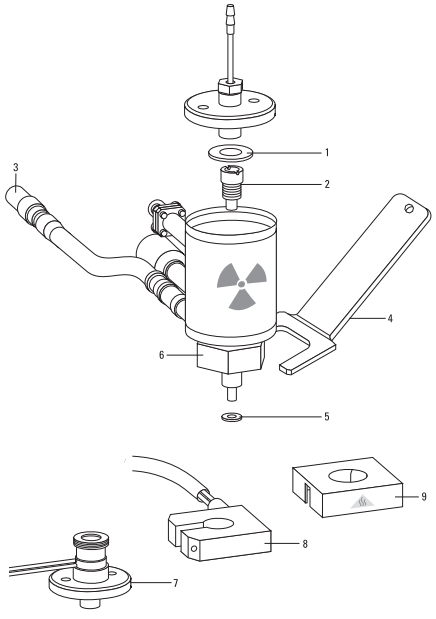
Item	Description	Cat. No.	Quantity
1	NPD collecting electrode	**25901110**	1
2	Ceramic insulator	**30202310**	1
3	Collecting electrode pin	**20601602**	1
4	Retaining screw	**31106008**	1
5	TS-2 source (standard)	**46500255**	1
5	TS-1 source for ENS mode	**46500250**	1
6	NPD jet	**40404302**	1
6	NPD (deactivated silcosteel) jet	**40404303**	1
7	Jet removing tool	**20501900**	1



Nitrogen Phosphorus Detector (NPD), TRACE GC Ultra

Electron Capture Detector (ECD), TRACE GC Ultra

Item	Description	Cat. No.	Quantity
1	Upper seal, aluminum	**29032608**	10
2	ECD collecting electrode	**27700350**	1
3	ECD fixing tool	**20502150**	1
4	Lower seal, silver	**29015058**	2
5	ECD blocking nut	**35001120**	1
6	Adapter for stack configuration	**34709007**	1
7	Heating block for stacked configuration (including heater and RTD)	**35425064**	1
8	Cover for heating block	**24104449**	1

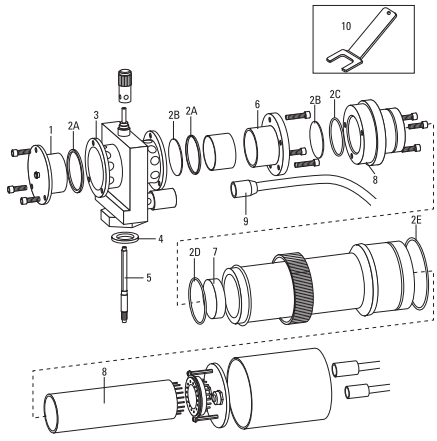


Electron Capture Detector (ECD), TRACE GC Ultra

Flame Photometric Detector (FPD), TRACE GC Ultra

Item	Description	Cat. No.	Quantity
1	Mirror plug	**35005350**	1
2A	Graphite seal	**19004589 (*)**	2
2B	Heat shield	**19004589 (*)**	2
2C	Viton® O-ring	**19004589 (*)**	1
2D	Viton® O-ring	**19004589 (*)**	1
2E	Viton® O-ring	**19004589 (*)**	1
3	Detector body	**19050111**	1
4	Aluminium O-ring	**29032630**	10
5	FPD jet	**40404511**	1
5	FPD (deactivated Silcosteel) jet	**40404512**	1
6	Flange and relevant Viton® O-ring	**36814235**	1
7	Interferential filter for sulphur	**28107000**	1
7	Interferential filter for tin	**28107001**	1
7	Interferential filter for phosphorus	**28107100**	1
8	Photomultiplier	**28600450**	1
9	Heater/sensor/coil cable	**23043479**	1
10	FPD fixing tool	**20502150**	1
11	FPD blocking nut	**35001125**	1

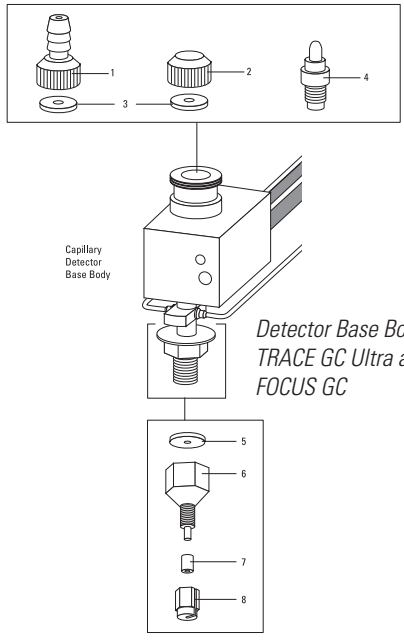
** Maintenance kit for FPD*



Flame Photometric Detector (FPD), TRACE GC Ultra

Detector Base Body, TRACE GC Ultra and FOCUS GC

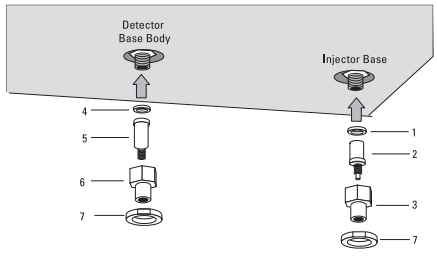
Item	Description	Cat. No.	Quantity
1	Adapter for flow measurement	**35004107**	1
2	Brass blind cap	**35006101**	1
3	Silicon seal	**29033037**	10
4	Blind jet	**40401900**	2
5	Seal, silver	**29037100**	10
6	Adapter for capillary column	**34725436**	2
7	Graphite ferrule	**See page 3-091**	
8	Fixing nut for column	**35032423**	5



Detector Base Body, TRACE GC Ultra and FOCUS GC

UltraFast Module Option – UFM S/SL-FID Configuration, TRACE GC Ultra

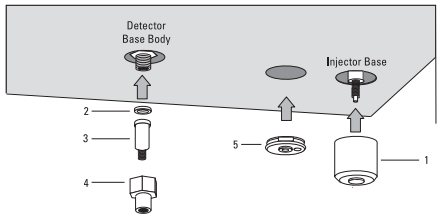
Item	Description	Cat. No.	Quantity
1	Silver seal for injector base	**29033629**	10
2	Terminal fitting for capillary column	**34705458**	1
3	1/4in. retaining nut for injector base	**35002132**	1
4	Silver seal for detector base	**29037100**	10
5	Terminal fitting for detector base	**34705456**	1
6	M8 x 1 retaining nut for detector base	**35002134**	1
7	Threaded locking ring	**35001468**	1



UltraFast Module Option – UFM S/SL-FID Configuration, TRACE GC Ultra

UltraFast Module Option – UFM PTV-FID Configuration, TRACE GC Ultra

Item	Description	Cat. No.	Quantity
1	Injector guide	**24104482**	1
2	Silver seal for detector base	**29037100**	10
3	Terminal fitting for detector base	**34705457**	1
4	M8 x 1 PTV retaining nut for detector base	**35002130**	1
5	Supporting disk	**36812760**	1



UltraFast Module Option – UFM PTV-FID Configuration, TRACE GC Ultra

TriPlus GC Autosampler

- Flexible sampling solutions for liquid, headspace and SPME
- Quick installation for easy start-up
- Double productivity with simultaneous operation of two different Thermo Scientific GC or GC/MS systems

The Thermo Scientific TriPlus autosampler is the evolution of autosamplers based on three dimensional (XYZ) space movements of the syringe holder. Besides conventional injection of liquid or headspace, this platform delivers unique "pluses" conceived to increase your lab's efficiency and productivity:

- Snap-on interchangeability of liquid, headspace and SPME™* configurations
- Quick mechanical installation of mainframe and accessories
- Self-alignment procedure and self-recognition of all installed accessories
- Simultaneous automation of independent sampling methods on two GC/GC-MS units
- Rugged SPME automation

**Sold under license from Supelco®*

Syringe Holders

Description	Cat. No.	Quantity
Syringe holder for 50mm needles (5, 10, 100, 250µL syringes)	**25401010**	1
Syringe holder for 50mm needles (0.5, 10, 100, 500µL syringes)	**25401015**	1
Syringe holder for 80mm syringe needles (5, 10, 100, 250µL syringes)	**25401020**	1
Syringe holder for 80mm syringe needles (0.5, 10, 100, 500µL syringes)	**25401025**	1
Syringe holder for TriPlus headspace	**36503008**	1
Syringe holder for SPME fiber	**25401080**	1

Syringe Holders

Sample Trays

Description	Cat. No.	Quantity
Ambient tray holder, configurable in field as primary or secondary	**36812755**	1
Primary ambient tray, positions 1 – 150, for 1, 2, 2.5mL vials	**24010150**	1
Primary ambient tray, positions 1 – 54, for 10, 20mL vials	**24010160**	1
Secondary ambient tray, positions 151 – 300, for 1, 2, 2.5mL vials	**24010155**	1
Secondary ambient tray, positions 55 – 108, for 10, 20mL vials	**24010165**	1
Cooled/Heated tray holder, configurable in field as primary or secondary	**24010190**	1
Primary cooled/heated tray, positions 1 – 96, for 1, 2, 2.5mL vials	**24010195**	1
Primary cooled/heated tray, positions 1 – 33, for 10mL vials	**24010200**	1
Secondary cooled/heated tray, positions 97 – 192, for 1, 2, 2.5mL vials	**24010215**	1
Secondary cooled/heated tray, positions 34 – 66, for 10mL vials	**24010220**	1

Sample Trays

Washing Stations

Description	Cat. No.	Quantity
Standard 5 x 10mL washing station	**19050390**	1
2 x 100mL washing station	**19050400**	1
Fast washing station	**19050401**	1

Washing Stations

Turrets and Oven

Description	Cat. No.	Quantity
Turret AS	**25401050**	1
Turret HS	**25401060**	1
HS incubation oven/agitator	**35408070**	1

SPME

Description	Cat. No.	Quantity
SPME fiber holder kit (only for TriPlus with turret s/n above 20066157)	**19050434**	1
SPME fiber conditioning station (only for TriPlus s/n above 20066529)	**19050502**	1

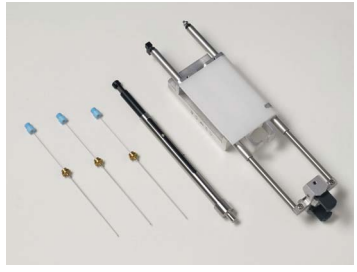
Septum Caps

Description	Cat. No.	Quantity
Septum cap for SSL suitable for HS and SPME	**34750004**	1
Septum cap for PTV suitable for HS and SPME	**35001048**	1
Septum cap for Merlin Valve SSL-PTV	**35001056**	1

Bar Code Reader

Description	Cat. No.	Quantity
Bar code reader	**19050490**	1
Magnetic 9mm caps for bar code reader	**38606095**	100
Labels for bar code reader	**38706782**	1000

SPME Fiber Conditioning Station



SPME Fiber Holder Kit

Bar Code Reader

AI/AS 3000 and AI/AS 3000 Series II Autosamplers

- Automated sampling systems for all Thermo Scientific GC and GC/MS systems
- Performance and simplicity in liquid sampling
- "Tool-Free" upgradability from 8 to 105 vial positions

Engineered to meet the highest level requirements of ruggedness and ease of use, the 3000 Series II automatic sampling system is ideal for high throughput and QA/QC control on the Thermo Scientific GC and GC/MS product portfolio. Utmost precision and ease-of-use of the plug and inject concept are combined in two available configurations: 8-position single module system for small batches of samples; 105-position tray system for high sample throughput. Boost productivity further with the Gemini configuration, which allows two autosamplers to be mounted on the same GC, serving two injection ports simultaneously.

AS 3000 II 8-vial Autoinjector

AS 3000 II 105-vial Autosampler

AI/AS 3000 and AI/AS 3000 Series II Autosamplers

Description	Cat. No.	Quantity
Waste bottle complete with septum and cap (Set of 5)	**19004646**	1
Tray 8-position holder	**24010140**	1
Tray 105-position assembly	**25117445**	1
Centering Plate for Merlin Adapter on S/SL injector	**36812734**	1
Centering plate for PTV injector and Merlin Adapter on PTV injector	**36812736**	1
Centering plate for S/SL injector	**36812738**	1

ISQ Innovative Single Quadrupole GC-MS

- Unique Full Source Removal™ capability delivers maximum uptime and unstoppable productivity
- ExtractaBrite™ solid, inert ion source provides robust operations and low detection limits
- Versatile and flexible for a broad range of applications

Re-think the way your lab operates with the Thermo Scientific ISQ single quadrupole GC-MS system. The ISQ™ GC-MS incorporates an innovative source design that keeps the ISQ cleaner, longer. With heat throughout the ion optics, the ISQ can analyze more samples per day, with maximum uptime. Easy to learn, easy to use, and easy to maintain, the ISQ was developed to meet the needs of the modern analytical laboratory.

Ion Source Components

Description	Cat. No.	Quantity
EI Ion Source Cartridge Kit	**120404-4100**	1
Ion Cartridge	**1R120404-1105**	1
EI Ion Volume	**1R120404-4111**	1
Ion Volume-Repeller Insulator	**1R120404-1114**	1
Repeller (Low Activity)	**1R120404-1161**	1
Ion Volume Locking Ring	**1R120404-1118**	1
Repeller Spring (pkg of 5)	**1R76485-1000K**	5
Repeller Nut	**1R120404-1120**	1
Lens 1	**1R120404-1130**	1
Lens 2	**1R120404-1140**	1
Lens 3/RF Lens	**120404-1150**	1
Ion Volume, CI	**1R120404-4112**	1
Ion Volume, EI/CI Combo	**1R120404-4113**	1
CI Ion Source Cartridge Kit	**120404-4400**	1
Dual Filament	**1R120404-1900**	1

Column Components

Description	Cat. No.	Quantity
Graphite Vespel ferrule for 0.25mm columns	**1R76458-2016**	10
Graphite Vespel ferrule for 0.32mm columns	**1R76458-2019**	10
Graphite Vespel ferrule for 0.53mm columns	**1R76458-2020**	10
2-hole graphite Vespel ferrule for <0.32mm column	**1R76458-2018**	10
No-hole graphite Vespel ferrule	**1R76458-2009**	10
SilTite ferrule for 0.10-0.25mm ID column	**1R76458-2000**	10
SilTite ferrule for 0.32mm columns	**1R76458-2024**	10
SilTite ferrule for 0.53mm columns	**1R76458-2026**	10
Nut for SilTite ferrules	**1R76458-2001**	5
Nickel-coated nut for graphite Vespel ferrule	**1R76256-0060**	5

Mechanical (rotary-vane) Pump

Description	Cat. No.	Quantity
Oil, rotary-vane pump	**A0301-15101**	1

Accessories

Description	Cat. No.	Quantity
Aluminum oxide	**32000-60340**	1
Calibration Compound (perfluorotributylamine)	**50010-30059**	1
Forceps	**1R76360-0008**	1
ISQ Tool Kit (Does not include exchange tool)	**1R120467-0001**	1
Source Exchange Tool	**1R120406-2000**	1
Column Measuring Tool	**1R120461-0010**	1
Manifold o-ring	**1R3815-360**	1
Vent valve o-ring	**1R3814-111**	1
Oil mist filter	**1R76505-0036**	1
Electron Multiplier	**1R76022-14633**	1
T10 Torxhead Key	**1R3812-5T10**	1
T20 Torxhead Key	**1R3812-5T20**	1
T30 Torxhead Key	**1R3812-5T30**	1
Test mix, octofluoronapthalene, benzophenone	**1R120151-TEST**	1

DSQ Series Single Quadrupole GC-MS Systems

- Sensitivity and large dynamic range for demanding analyses
- Proven performance for difficult samples
- Analytical flexibility for applications from research to routine

The Thermo Scientific DSQ Series of single quadrupole GC-MS systems includes the DSQ and DSQ II mass spectrometers. The DSQ Series mass spectrometers are available with either the TRACE GC Ultra gas chromatograph, or the compact FOCUS GC. Featuring an innovative curved prefilter for reduction of neutral noise, resulting in excellent sensitivity and lower detection limits, the DSQ Series of single quadrupole GC-MS products are suitable for a wide variety of applications.

DSQ II Spare Parts

Description	Cat. No.	Quantity
Magnet yoke	**119850-0710**	1
Magnet	**1R70001-98195**	1
Ion volume holder, Standard	**70001-20532**	1
Ion volume, EI	**119650-0220**	1
Ion volume, CI	**119650-0230**	1
Ion volume, EI/CI Combo	**119650-0240**	1
Ion volume kit, CEI w/holder	**119650-0221-KIT**	1
Ion volume holder, CEI Only	**70001-20532-T**	1
Ion volume, CEI	**119650-0221-T**	1
Lens heater ring	**120320-0020**	1
Lens assembly, Complete	**119650-0151**	1
Lens holder	**119650-0420**	1
Lens 1	**119650-0414**	1
Lens 2	**119650-0416**	1
Lens 3	**119650-0423**	1
Lens spacer	**119650-0426**	1
Lens retainer clip	**119650-0428**	1
Prefilter lens spacer	**119800-0475**	1
Prefilter lens	**119800-0535**	1
Prefilter lens retainer clip	**120173-0002**	1
Source alignment studs	**119650-0215**	1
Ion source heater assembly	**120309-0001**	1
Source block assembly	**120320-0101**	1
Lens retainer clip	**120320-0040B**	1
Lens retainer stud	**120320-0041**	1
Ion volume index screw	**120320-0042**	1
Filament	**120320-0030**	1
Filament insulator/spacer	**119650-0235**	1
Filament retainer clip	**120320-0050**	1
Lens alignment tool	**120271-0001**	1

DSQ Spare Parts

Description	Cat. No.	Quantity
Ion source assembly (complete)	**119850-0250**	1
Lens alignment tool	**120271-0001**	1
Magnet	**1R70001-98195**	1
Magnet support	**119850-0710**	1
Source spacer assembly	**119800-0475**	1
Spring	**76485-0032**	1
Thumbscrew	**119825-0100**	1
Filament	**119701-60287**	1
Filament spacer/insulator	**119650-0235**	1
Ion source PCB	**96000-60087**	1
Ion volume, CI	**119650-0230**	1
Ion volume, EI	**119650-0220**	1
Ion volume, EI/CI combo	**119650-0240**	1
Ion volume holder	**70001-20532**	1

DSQ and DSQ II Accessories and Spares

Inlet Valve (Upgrade Option)

Description	Cat. No.	Quantity
Ball valve seal replacement kit	**76461-2002**	1
Inlet valve seal replacement kit	**119265-0003**	1

Accessories

Description	Cat. No.	Quantity
Allen wrench kit, metric	**3812-0100**	1
Aluminum oxide	**32000-60340**	1
Back ferrule, 1/8in, brass	**A0101-02500**	1
Calibration compound (perfluorotributylamine)	**50010-30059**	1
Column measuring tool	**119640-0550**	1
Forceps	**76360-0400**	1
Front ferrule, 1/8in, brass	**A0101-08500**	1
Test mix, octafluoronaphthalene, benzophenone	**120150-TEST**	1
Transfer line ferrule, 1/16in to 0.4mm, graphite/vespel	**A0101-18100**	1

Mechanical (rotary-vane) Pump

Description	Cat. No.	Quantity
Oil, rotary-vane pump	**A0301-15101**	1

ITQ Series External Ionization GC-Ion Trap MS

- Excellent sensitivity in full-scan operation
- Advance to the power of MS^n for incredible selectivity in the dirtiest of matrices
- External ionization source for maximum productivity, reliability, and classical, library searchable spectra

The Thermo Scientific ITQ Series is designed with the ability to upgrade in mind, protecting your investment by adapting to your lab's changing work-flows and needs over time. If your needs change, upgrade your instrument to gain access to new features, greater flexibility, more power. Better yet, regardless of your choice, you will have the most sensitive GC-ion trap mass spectrometer available, giving you lower detection limits, even in matrix.

The ITQ Series offers a range of operating modes, from full-scan MS and MS/MS (MS^n), to positive and negative chemical ionization. Dual modes for sequential full scan and MS/MS or positive ion/negative ion chemical ionization (PPINICI) allow you to acquire both types of data in a single injection. Variable damping gas, an option available exclusively on the ITQ Series, further improves GC/MS sensitivity up to 5X or more across a broad range of real-world samples. Data Dependent™ scanning allows you to quickly collect data, confirm the identity of compounds, and further reduce sample cleanup costs.

Ion Source Spare Parts

Description	Cat. No.	Quantity
Magnet support thumbscrew	**76483-0125**	1
Compression spring	**76485-0032**	1
Set screws	**76905-0405**	1
Magnet support yoke	**119650-0710**	1
Magnet	**1R70001-98195**	1
Ion volume holder, standard	**70001-20532**	1
Ion volume, EI	**119650-0220**	1
Ion volume, CI	**119650-0230**	1
Ion volume, EI/CI combo	**119650-0240**	1
Ion volume, closed exit (CEI)	**119650-0221-T**	1
Ion volume holder, CEI only	**70001-20532-T**	1
Lens heater ring	**119650-0422**	1
Lens assembly, complete	**119650-0150**	1
Lens holder	**119650-0420**	1
Lens 1	**119650-0414**	1
Lens 2	**119650-0416**	1
Lens 3	**119650-0418**	1
Lens spacer	**119650-0426**	1
Lens retainer clip	**119650-0428**	1
Filament	**120320-0030**	1
Filament spacer/insulator	**119650-0235**	1
Filament retainer clip	**120320-0050**	1
Ion source PCB	**96000-60087**	1
Ion source block	**119650-0205**	1
Ion volume key thumbscrew	**119650-0206**	1
Heater RTD Spring	**96000-20176**	1
Heater RTD spring thumbscrew	**119650-0208**	1

Ion Trap Spare Parts

Description	Cat. No.	Quantity
Endcap electrode	**119650-0520**	1
Spacer	**119650-0540**	1
Ring electrode	**119650-0525**	1
Exit lens	**119650-0530**	1
Exit lens spacer	**119650-0515**	1
Helium inlet	**119650-0532**	1

Inlet Valve (Upgrade Option)

Description	Cat. No.	Quantity
Ball valve seal replacement kit	**76461-2002**	1
Inlet valve seal replacement kit	**119265-0003**	1

Mechanical (Rotary-vane) Pump

Description	Cat. No.	Quantity
Oil, rotary-vane pump, 1L	**A0301-15101**	1

Accessories

Description	Cat. No.	Quantity
Allen wrench kit, metric	**3812-0100**	1
Aluminum oxide	**32000-60340**	1
Calibration compound (perfluorotributylamine)	**50010-30059**	1
Back ferrule, 1/8in., brass	**A0101-02500**	1
Column measuring tool	**119640-0550**	1
Ion volume tool	**119270-0001**	1
Front ferrule, 1/8in., brass	**A0101-08500**	1
Test mix, octafluoronapthalene and decafluorobenzophenone (DFBZ)	**120420-TEST**	1
Transfer line ferrule, 1/16in to 0.4mm, graphite/vespel	**A0101-18100**	1

Polaris*Q* External Ionization Ion Trap GC/MS

- Stop matrix interference with the power of MS^n
- Outstanding sensitivity in full scan mode
- Reliability, robustness, and library-searchable data from external ionization source

The Thermo Scientific Polaris*Q* is a high quality benchtop ion trap GC/MS system with EI, CI, Negative CI, MS/MS and direct sample probe capability. Proprietary Pulsed Positive Ion/Negative Ion Chemical Ionization (PPINICI) and variable buffer gas options enhance ppb sensitivity and performance in the toughest sample matrices. External ionization ensures data integrity, while providing robust, reliable performance.

Ion Source

Description	Cat. No.	Quantity
CI ion volume	**119650-0230**	1
EI ion volume	**119650-0220**	1
EI/CI combo ion volume	**119650-0240**	1
Filament	**119701-60287**	1
Filament spacer	**119650-0235**	1
Ion source PCB	**96000-60087**	1
Ion volume holder	**70001-20532**	1

Mechanical (Rotary-Vane) Pump

Description	Cat. No.	Quantity
Oil, rotary-vane pump, 1L	**A0301-15101**	1

Inlet Valve (Upgrade Option)

Description	Cat. No.	Quantity
Ball valve seal replacement kit	**76461-2002**	1
Inlet valve seal replacement kit	**119265-0003**	1

Accessories

Description	Cat. No.	Quantity
Allen wrench kit, metric	**3812-0100**	1
Aluminum oxide	**32000-60340**	1
Back ferrule, 1/8in., brass	**A0101-02500**	1
Calibration compound	**50010-30059**	1
Filament	**119701-60287**	1
Front ferrule, 1/8in., brass	**A0101-08500**	1
Test mix, 100ng/µL decafluorobenzophenone, benzophenone, methyl stearate	**A0301-23057**	1
Test mix, 100pg/µL, 10pg/µL, and 1pg/µL decafluorobenzophenone	**96000-98044**	1
Transfer line ferrule, 1/16in. to 0.4mm, graphite/Vespel	**A0101-18100**	1

TSQ Quantum GC and TSQ Quantum GC XLS Triple Quadrupole GC-MS/MS

- Higher compound sensitivity
- More matrix selectivity
- More productivity

The Thermo Scientific TSQ Quantum GC is the latest evolution in triple quadrupole GC-MS/MS-. The TSQ Quantum GC provides unprecedented sensitivity for target compound analysis in complex samples. Timed selected reaction monitoring (t-SRM), unique to the TSQ Quantum GC, detects compounds at the expected elution time, with optimum sensitivity, independent of the total number of compounds, a feature no other GC-triple quadrupole MS can provide.

Ion Source

Description	Cat. No.	Quantity
Ion source assembly, complete	**119850-0250**	1
Magnet, TSQ Quantum GC XLS	**1R70001-98195**	1
Magnet	**70001-98195**	1
Magnet support	**1R119850-0710**	1
Source spacer assembly	**119800-0475**	1
Spring	**76485-0032**	1
Lens 1, TSQ Quantum GC	**119650-0414**	1
Lens 2, TSQ Quantum GC	**119650-0416**	1
Lens 3, TSQ Quantum GC	**119650-0423**	1
Lens housing	**119650-0420**	1
Lens insulator	**119650-0426**	1
Ion volume, EI, stainless steel	**70111-22036**	1
Ion volume, CI	**70111-22037**	1
Ion volume, closed exit (CEI), stainless steel	**70111-22038**	1
Ion volume holder, stainless steel	**70001-20532**	1
Ion volume, closed exit (CEI), inert, "P"-type	**70111-22202**	1
Ion volume, closed exit (CEI), inert	**70111-22147**	1
Ion volume holder, inert	**70001-20532-T**	1
Lens 1, TSQ Quantum GC XLS	**1R119650-3414**	1
Lens 2, TSQ Quantum GC XLS	**1R119650-3416**	1
Lens 3, TSQ Quantum GC XLS	**1RR119650-3423**	1
GC-source/Q00 Heather, XLS-TSQ	**70111-60840**	1
Ball Plunger, 5/40 modified	**70111-22062**	1
Assy, Lens 1,2,3, GC Source, Heated, XLS-TSQ	**70111-60842**	1
Lens Circlip Ion Trap/DSQ	**119650-0428**	1
Lens, 1,2,3 Holder, Source, XLS-TSQ	**70111-22197**	1
Quad Spacer Ceramic, Heated, Q0, XLS-TSQ	**70111-22200**	1
Orientation Spacer, Q0, XLS-TSQ	**70111-22201**	1
Ceramic Heather PCB Assy, XLS-TSQ	**70111-60848**	1

Ion Source Block

Description	Cat. No.	Quantity
Filament	**120320-0030**	1
Filament spacer	**70111-22061**	1
Filament retainer clip	**70111-22071**	1
Ion source heater board	**70111-60780**	1
Source block	**70111-60791**	1
Source alignment studs	**70111-22056**	1
Lens retainer clip	**70111-22070**	1
Lens retainer screw	**70111-22060**	1

Inlet Valve

Description	Cat. No.	Quantity
Ball valve seal replacement kit	**76461-2002**	1
Inlet valve seal replacement kit	**119265-0003**	1

Mechanical (Rotary-Vane) Pump

Description	Cat. No.	Quantity
Oil, rotary-vane pump, 1L	**A0301-15101**	1

Accessories

Description	Cat. No.	Quantity
Allen wrench kit, metric	**3812-0100**	1
Aluminum oxide	**32000-60340**	1
Back ferrule, 1/8in., brass	**A0101-02500**	1
Front ferrule, 1/8in., brass	**A0101-08500**	1
Forceps	**76360-0400**	1
Calibration compound (FC-43)	**50010-30059**	1
Transfer line ferrule, 1/16in. to 0.4mm, graphite/Vespel	**A0101-18100**	1
Electron multiplier, with flange	**70001-98175**	1
Kit, calibration compound vial	**120433-0001**	1

DFS High Resolution GC/MS

- Ultra high sensitivity analysis of dioxins, BFRs and other POPs
- Highest sample throughput at lowest LOQs
- Highest reliability of analytical results

The Thermo Scientific DFS is the highest performance, highest resolution GC/MS ever built for target compound analysis and structural elucidation, and the first completely new instrument of its class in more than 15 years. It delivers unprecedented flexibility and productivity for large sample series and can optionally be equipped with two TRACE GC Ultra™ units, simultaneously installed at the same ion source. The DFS is designed for unattended operation, with highest sample capacity and ultimate sampling flexibility.

MAT95 Double Focusing Sector Field Mass Spectrometer

- Proven performance for target compound confirmation in environmental, food safety and forensic, sports doping analysis
- Versatile for structure elucidation using multiple inlet systems

The Thermo Scientific MAT95 XP has been the high-end workhorse in the analysis of polychlorinated dioxins and furans for many years. It combines unprecedented sensitivity with the ruggedness of a benchtop instrument. It is highly versatile and can be equipped with various ionization methods, such as EI, CI, FAB, ESI and APCI.

High Resolution MS General Spares, DFS, MAT95/900

Description	Cat. No.	Quantity
Filament, EI Operation, Tungsten, for DFS/MAT95/900	**1062950**	1
Filament, CI Operation, Rhenium, for DFS/MAT95/900	**1062960**	1
Ion volume for exchange, EI operation	**1082100**	1
Ion volume for exchange, CI operation	**1082200**	1
Ion volume for exchange, ACE operation	**1082250**	1
Ion volume for exchange, FAB operation	**1082240**	1
SEV Unit, electron multiplier for DFS/MAT95/900	**1090010**	1
DIP aluminum crucibles for solid samples	**0568761**	200
Septum 12.5 PTFE coated	**0553371**	1
Source heater	**0491940**	1
Ferrule Vespel 1/16" transfer line	**0492490**	1

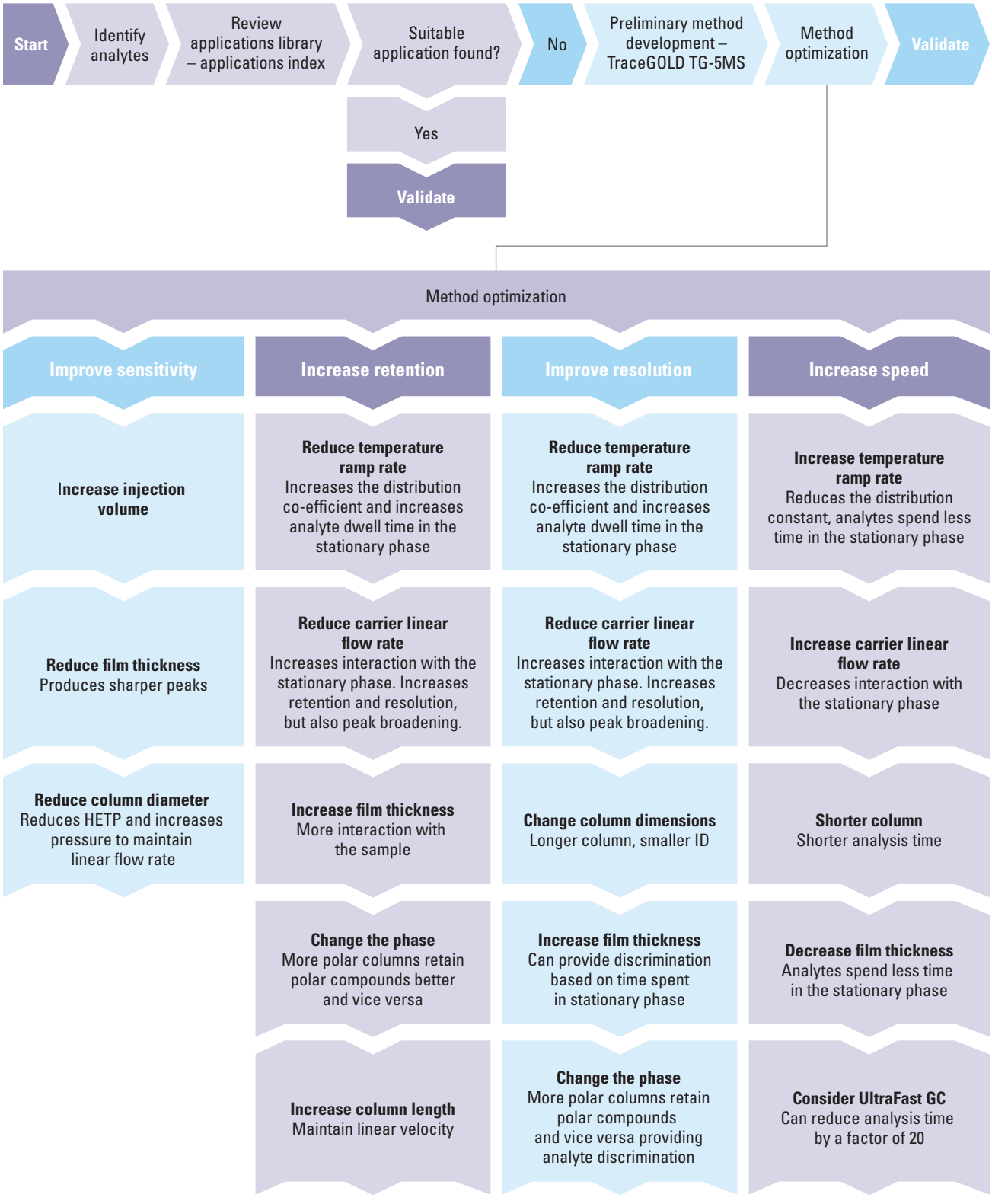
High Resolution MS General Spares, DFS, MAT95/900

Description	Cat. No.	Quantity
DIP aluminum crucibles for liquid samples	**0568770**	200
DIP aluminum crucibles for liquid samples, caps	**568780**	200
DIP gold crucibles	**0574200**	1
DIP-HT quartz crucibles	**1006070**	10
Crucible holder	**0568770**	
DCI wire units	**0744860**	1

GC Technical Information

GC Method Selection and Optimization

The following flow chart briefly describes the common steps in GC method development and optimization.


Start
Identify analytes
Review applications library – applications index
Suitable application found?
No
Preliminary method development – TraceGOLD TG-5MS
Method optimization
Validate
Yes
Validate
Method optimization
Improve sensitivity
Increase retention
Improve resolution
Increase speed
Increase injection volume
Reduce temperature ramp rate
Increases the distribution co-efficient and increases analyte dwell time in the stationary phase
Reduce temperature ramp rate
Increases the distribution co-efficient and increases analyte dwell time in the stationary phase
Increase temperature ramp rate
Reduces the distribution constant, analytes spend less time in the stationary phase
Reduce film thickness
Produces sharper peaks
Reduce carrier linear flow rate
Increases interaction with the stationary phase. Increases retention and resolution, but also peak broadening.
Reduce carrier linear flow rate
Increases interaction with the stationary phase. Increases retention and resolution, but also peak broadening.
Increase carrier linear flow rate
Decreases interaction with the stationary phase
Reduce column diameter
Reduces HETP and increases pressure to maintain linear flow rate
Increase film thickness
More interaction with the sample
Change column dimensions
Longer column, smaller ID
Shorter column
Shorter analysis time
Change the phase
More polar columns retain polar compounds better and vice versa
Increase film thickness
Can provide discrimination based on time spent in stationary phase
Decrease film thickness
Analytes spend less time in the stationary phase
Increase column length
Maintain linear velocity
Change the phase
More polar columns retain polar compounds and vice versa providing analyte discrimination
Consider UltraFast GC
Can reduce analysis time by a factor of 20

GC Troubleshooting

Before you start any troubleshooting, it is essential to observe safe laboratory practices. Know the chemical and physical properties of any solvents used and have the appropriate Material Safety Data Sheets (MSDSs) readily available. All electrically powered instruments should be shut down and unplugged before starting. Eye protection should also be worn.

The following table lists common GC problems encountered, the possible causes and solutions for your quick reference.

Symptom	Cause	Recommended Solutions
Baseline Related Problems		
Baseline Drifting	Accumulation of stationary phase.	Remove the end section of the column.
	Carrier gas cylinder pressure too low to allow control.	Replace the carrier gas cylinder. Increase the pressure.
	Drifting carrier gas or combustion gas flows.	Check the gas controllers.
	Accumulation of impurities in the column.	Check impurity levels in the gas source. Use correct gas purity. Replace or install appropriate Gas Filters (see page 3-080).
Baseline Falling	Carrier gas leak in the system.	Perform a leak test. Check the tightness of the connections on the carrier gas line.
	Column is baking out.	Allow enough time for the column to stabilize.
Baseline Falling Away Slowly After a High Initial Value	Purge valve left closed during acquisition.	Alter the GC program. See your GC user manual for details.
	Inadequate purge flow rate.	Increase the purge flow rate.
	Purge valve left closed for too long.	Shorten the purge time.
	Solvent tail peak.	Increase the solvent delay. Shorten the purge time.
	Pre-filters are dirty. (when using a quadrupole MS detector)	Contact your service representative.
Baseline Rising	Accumulation of impurities in the column.	Check impurity levels in the gas source. Use correct gas purity. Replace or install appropriate Gas Filters (see page 3-080).
	Contaminated detector.	Check the detector and clean it.
	There is bleeding from the GC column.	Condition column. Change the column.
	Air is leaking into the system.	Trace and repair the leak.
Baseline Rising Under Temperature Program Control	Column contaminated.	Recondition the column.
Baseline High Standing Current	Carrier gas flow rate too high.	Reduce the carrier gas flow.
	Column contaminated.	Recondition the column.
	Contaminated gases.	Replace gas cylinders. Replace the gas filters.
	Excessive column stationary phase bleeding.	Check the oven temperature, ensuring that it doesn't exceed the column upper limit. Recondition the column. Replace the column.
	Loose connections.	Ensure that all interconnections and screw connections are tight.
Baseline Irregular Shape: Dip After Solvent Peak	Detector contaminated.	Bake out the detector. Clean the detector.
Baseline Irregular Shape: S-shaped	Excessive column bleed during column temperature programming.	Reduce the upper column temperature. Bake out the column. Install a high temperature column.
	Oxygen contamination is decomposing the stationary phase.	Install oxygen filters in the carrier gas line. Check the pneumatic and inlet systems for leaks. Use correct gas purity with low oxygen content.
Baseline High Frequency Noise	Contaminated detector.	Isolate the detector from the electronics. If noise disappears, clean the collector.
	Combustion gas flow too low or too high.	Check the detector gas flows.
	Column contaminated.	Condition the column.
	Contaminated detector gas supply.	Check the gas purity and install appropriate filters.
	Detector temperature higher than column maximum temperature.	Reduce the detector temperature to the column temperature upper limit.
	Loose column fittings.	Tighten fittings accordingly.
Baseline Spiking	Column too close to flame. (when using an FID)	Lower the column to the correct position (2-3mm below the tip of the jet).
	Dirty jet or detector.	Isolate the detector from the electronics. If the spiking disappears, clean the jet and the collector.
	FID temperature too low. (when using an FID)	Increase the FID temperature to at least 150°C.

GC Troubleshooting *continued*

Symptom	Cause	Recommended Solutions
Peak-Related Problems		
Peaks Broadening	Column flow too high.	Reduce the flow to slightly above optimum.
	Column flow too low.	Increase the flow to slightly above optimum.
	Split flow too low in split injection.	Increase the flow to 40-50mL/min.
	Column performances degraded.	Test the column at the optimum flow rate.
	Dirty injector.	Clean or replace the liner.
	Stationary phase accumulated in the outlet.	Remove the last two coils from the column.
	Detector base body temperature too low.	Increase the temperature to 5°C below the column maximum.
	The sample is overloading the column.	Reduce the amount and/or concentration of the sample.
Double Peaks	Injection speed too low.	Inject more rapidly in a smooth motion.
	Wrong autosampler injection speed or mode.	Use a higher speed.
Peak Fronting	Column or detector overloaded.	Decrease the injected amount. Decrease the analyte concentrations. Increase the split ratio.
	Column temperature too low.	Increase the temperature.
	Stationary phase too thin.	Use a thicker-film column.
	Poor injection technique.	Repeat, with better injection technique.
Ghost Peaks	Contaminated carrier gas.	Replace the cylinder. Replace the filter (see page 3-080).
	Contamination from laboratory glassware.	Ensure the glassware is clean and contamination-free.
	Decomposition of injected sample.	Decrease the injection port temperature. Use the on-column injection technique.
	Dirty injection solution.	Carry out adequate clean-up of sample prior to injection.
Broad Ghost Peaks	Contaminated inlet or pneumatics.	Remove the column and bake out the inlet. Use a high-quality septum. Replace the split vent filter. Install an in-line filter between the pneumatics and the inlet.
	Incomplete elution of previous sample.	Increase the final oven program temperature or total run time. Increase the column flow rate.
Irregular, Chair-shaped Peaks	Solvent flooding of column.	Increase the initial oven temperature. Reduce the injection volume (On-column). Install a retention gap (On-column).
No Peaks After Solvent Peak	Carrier gas flow too high.	Reduce the carrier gas flow rate.
	Combustion gas flow incorrect.	Check the combustion gas flow.
	Detector contaminated.	Bake out or clean the detector.
	FID flame extinguished by solvent peak.	Check the detector temperature and that flame is lit.
	Too much sample injected.	Inject less sample.
	Incorrect column position in S/SL injector (too high).	Check the column position.
No Peaks at All	Clogged syringe needle.	Replace or repair the syringe.
	Column broken or disconnected.	Check the column and connections.
	Defective electrometer or amplifier.	Check electrometer or amplifier and associated connections. Replace if required.
	Defective recording device.	Replace the recording device.
	FID flame is out.	Clean FID jet, check detector gas flows and re-light flame.
	Incorrect column position in S/SL injector (too high).	Check the column position.
Sample Peak Tailing	Column degradation causing activity.	Inject a test mixture and evaluate the column.
	Column/oven temperature too low.	Increase the column/oven temperature. Do not exceed the recommended maximum temperature for the stationary phase.
	Column contaminated at inlet.	Trim first 10-20cm from column and re-install in injector.
	Glass wool or inlet liner causing activity.	Replace with fresh silanized wool and a clean inlet liner.
	Inlet temperature too low.	Increase the inlet temperature.
	Poor or obstructed column connections.	Remake the column inlet connection.
	Wrong stationary phase.	Replace the column according to the column manufacturer's literature.
Solvent Peak Tailing	Incorrect column position in inlet.	Reinstall the column.
	Initial oven temperature too high (On Column).	Reduce the initial oven temperature.
	Septum purge flow too low and/or split/splitless vent flow too low.	Check and adjust the septum purge and vent flows.
	Too large injection size.	Reduce the injection size.

Symptom	Cause	Recommended Solutions
Unresolved Peaks	Carrier gas flow rate too high.	Reduce the carrier gas flow rate.
	Column deteriorated.	Replace the column.
	Column temperature too high.	Lower the column oven temperature.
	Column too short.	Use a longer column.
	Incorrect column choice.	Install a suitable column.
	Injection technique is not adequate.	Choose a correct injection technique.
Discrete High-intensity Contaminant Peaks	Bleed from the GC column.	Condition or change the column.
	Bleed from the septum.	Replace the septum.
	Sample vial septa are contaminating the sample.	Discard sample. Store samples upright, in a refrigerator. Use Teflon™ faced septa, with the Teflon facing downwards (i.e. towards the sample).
Results-Related Problems		
Low Reproducibility of Peak Area	Concentration not compatible with the dynamic range of the detection system.	Ensure that the sample concentration is suitable for the detection system.
	Inappropriate injection technique.	Try a different injection technique.
	Injection parameters inappropriate.	Check the injection temperature. Check the flow rates.
	Non reproducible sample injection technique.	Evaluate the sample preparation sequences. Compare the results with a series of standard injections.
	Leaking syringe or septum.	Check and replace the syringe at regular intervals. Check and replace septum at regular intervals.
	Leaks at the injection.	Check the column connections. Run a leak check.
	Poor injection technique.	Carefully meter the injected amount. Use a clean, good-quality syringe.
	Poor split flow or ratio control.	Monitor the flow. Replace the in-line filter.
Poor Sensitivity Increased Retention Time	Carrier gas flow rate too low.	Increase the carrier gas flow rate. Locate and remove possible with obstructions in the carrier gas line. Check the injector/column ferrules.
Poor Sensitivity with Normal Retention Time	Oven or injector parameters are not optimized.	Adjust the oven parameters. Adjust the injector parameters.
	Leaks in the GC carrier gas line.	Run a leak test and correct leaks.
	Syringe leaks during injection.	Replace syringe or piston seals, if applicable.
	Split injection temperature too low.	Increase the temperature of the injector.
	Column is in poor condition, or wrong column type used.	Condition the columns. Change the column.
Retention Times Decreasing	Stationary phase deteriorated by oxygen and/or water.	Use a carrier gas free of oxygen and water. Replace or install appropriate gas filters (see page 3-080 to 3-082).
	Stationary phase loss due to column bleeding.	Reduce the column temperature.
Retention Times Increasing	Increasing carrier leakage.	Check the septum and column connections.
	Carrier gas supply running out.	Replace the bottle.
Low Reproducibility of Retention Times	Drifting or unstable pneumatic controller.	Monitor the column pressure or flow. Check and replace the controller if necessary.
	Poor injection technique.	Start the run at consistent time after injection.
	Sample size is too large.	Reduce the injected amount and/or volume.
	Unstable column temperature.	Check the main oven door and cooling flap. Monitor the column temperature.
Retention Times are Inconsistent	GC column is in poor condition.	Condition the column. Change the column.
	Insufficient equilibration time set on GC.	Increase equilibration time.
	Poor injection.	Repeat with better injection technique.
	Oven temperature programmed to rise too quickly.	Reduce oven temperature ramp rate.
	Air is leaking into the system at the injector seal or the carrier gas manifold.	Trace and repair the leak.

*If you need more assistance or information on specific detection systems, please contact us and request our **Troubleshooting Guide**.*

GC Equations

Adjusted Retention Time (t_R')

An analyte's retention time (t_R) minus the elution time of an unretained peak (t_m).

$$t_R' = t_R - t_m$$

Adjusted retention time is also equivalent to the time the analyte spends in the stationary phase.

Capacity Factor (k)

Expression that measures the degree of retention of an analyte relative to an unretained peak, where t_R is the retention time for the sample peak and t_m is the retention time for an unretained peak. A measurement of capacity will help determine whether retention shifts are due to the column (capacity factor is changing with retention time changes) or the system (capacity factor remains constant with retention time changes).

$$k = \frac{t_R - t_m}{t_m}$$

Thus, the higher the capacity factor, the longer the retention time.

Effective Theoretical Plates (N_{eff})

A measure of a column performance that accounts for the effects of unretained elution time, where t_R' is the adjusted retention time and σ is the standard deviation of the peak.

$$N_{eff} = \left(\frac{t_R'}{\sigma}\right)^2$$

This value also remains constant as retention gaps and guards are used. Depending on the method of peak width calculation, different efficiencies can be reported. This leads to two popular measures:

$$N_{eff} = 16\left(\frac{t_R'}{W}\right)^2$$

Where W is the tangential peak width (13.4% peak height).

$$N_{eff} = 5.54\left(\frac{t_R'}{W}\right)^2$$

Where W is the width measured at half height (50% peak height).

HEEP (H_{eff})

Height Equivalent to an Effective Plate.

$$H_{eff} = L/N_{eff}$$

Where L is the column length. The smaller the N_{eff}, the more efficient the column's performance.

HETP (H)

Height Equivalent to a Theoretical Plate is a measure of column efficiency where L is the column length and N is the number of theoretical plates.

$$H = L/N$$

HETP is based on actual (t_R) rather than adjusted retention times (t_R').

Linear Velocity (u)

Mobile phase flow rate expressed in cm/s and is expressed as:

$$u = L/t_m$$

Where L is the column length and t_m is the breakthrough time of an unretained peak.

Phase Ratio (β)

The ratio of the volume of mobile phase to the stationary phase. An important value when changing the column dimensions in a method.

$$\beta = \frac{\text{column ID (µm)}}{4 \times \text{film thickness (µm)}}$$

Resolution

A measure of the separation of two peaks taking into account both the difference in elution time and the peak widths.

$$R_s = \frac{(t_2 - t_1)}{0.5\,(W_1 + W_2)}$$

Where t_2 and t_1 are the two retention times, and W_1 and W_2 are baseline peak widths.

Selectivity (α)

The relative retention of two adjacent peaks. Selectivity can be calculated using capacity factor.

$$\alpha = \frac{k_2}{k_1}$$

Trennzahl Number

A value to describe a separation. The Trennzahl number is calculated from the resolution between two consecutive homologous hydrocarbons. The Trennzahl number represents the number of peaks that can be included between the two hydrocarbon peaks.

$$T_z = \left(\frac{t_{R2} - t_{R1}}{(W_h)_1 + (W_h)_2}\right) - 1$$

Where t_R equals analyte retention time and W_h equals peak width at half height.

van Deemter Equation

This is a relationship that considers the effect of linear velocity on the HETP or H, where A accounts for eddy diffusion, B describes the molecular diffusion of the vapor in the direction of the column axis, C refers to the resistance to transfer from the stationary to mobile phase and u is the linear velocity of the mobile phase.

$$H = A + \frac{B}{u} + Cu$$

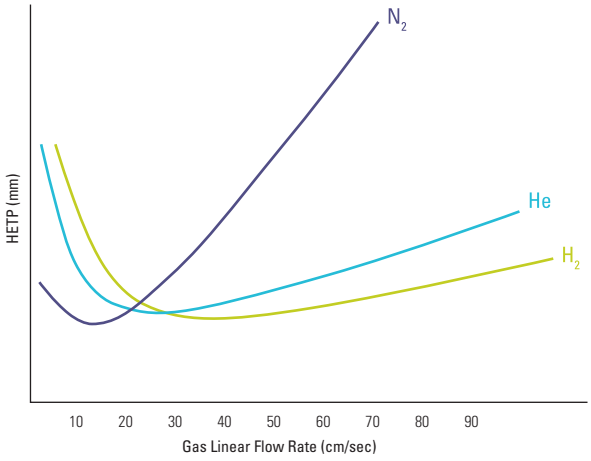
Carrier Gas Choice

The choice of carrier gas is a compromise between a number of considerations, among them, efficiency and speed as well as availability, safety and cost. The three most common carrier gases used are nitrogen, helium and hydrogen.

Nitrogen shows the lowest HETP, making it the most efficient of the gases. High quality nitrogen is readily available and inexpensive compared to other options. However, the optimum flow rate to achieve nitrogen's very low HETP leads to long analysis times (see figure).

Helium has a slightly lower efficiency than nitrogen, but the optimum flow rate is higher. Also small changes in flow rate of helium around the optimum will not affect efficiency as greatly as with nitrogen.

For many, hydrogen is the carrier gas of choice. It shows higher efficiency than helium and at a higher flow rate. The variation in HETP with changes in flow rate is also far lower, making it more forgiving and reproducible. There is, however, a slight risk of an explosive atmospheric build-up in the oven.



A van Deemter plot of efficiency against linear flow rate for three carrier gases.

Recommended Flow Rates and Velocities for Capillary Columns

Carrier Gas	0.25mm ID		0.32mm ID		0.53mm ID	
	mL/min	cm/min	mL/min	cm/min	mL/min	cm/min
He	1	35	1.7	35	6	35
H_2	1.6	50	2.6	50	7.5	50
N_2	0.4	14	0.5	11	0.9	7

Recommended Detector Gas Flow Rates

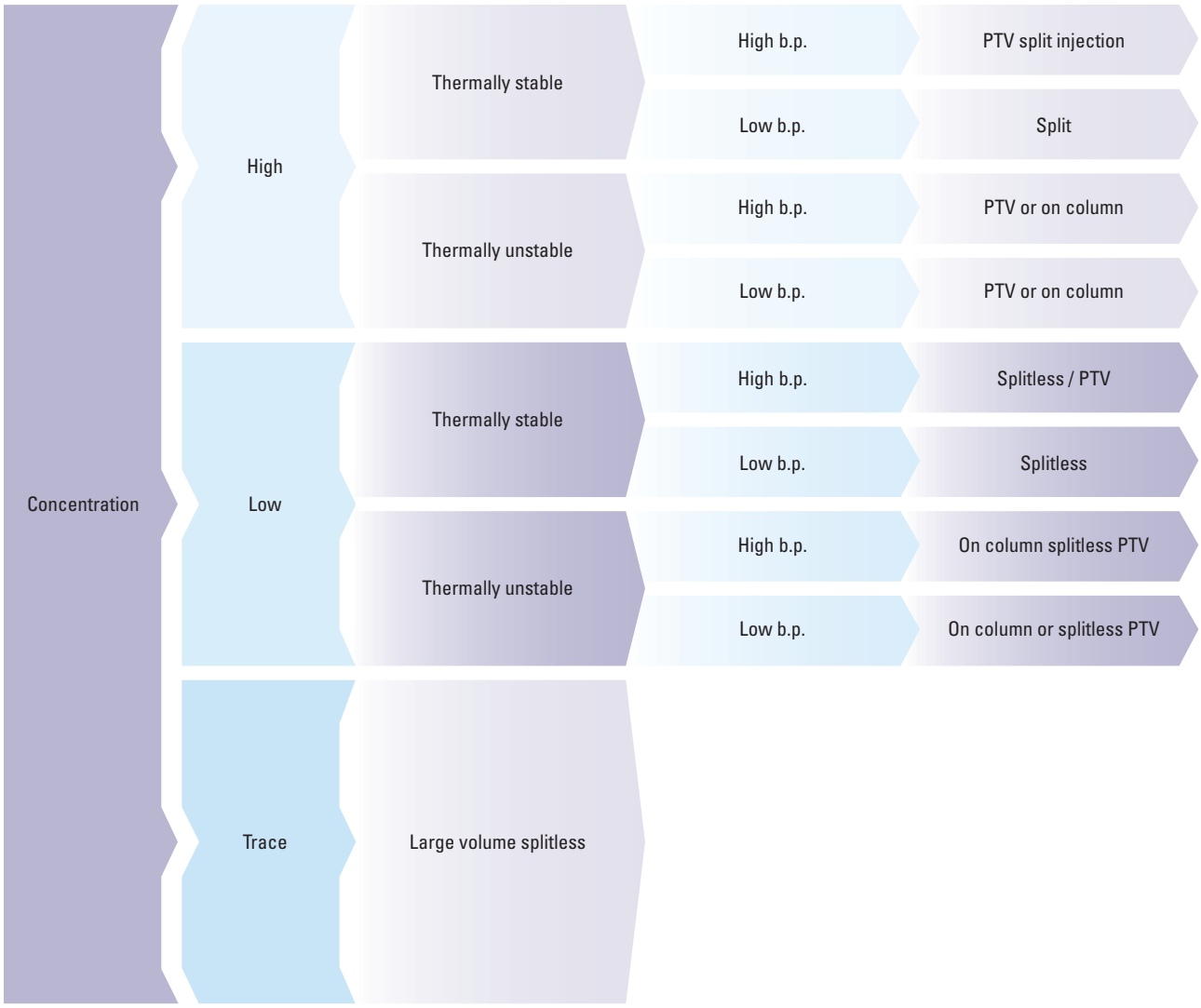
Detector	Air (mL/min)	H_2 (mL/min)	Make Up (mL/min)
ECD	–	–	35-40
FID	350	35	30
NPD	60	2.5	15
FPD	100	75	30

Unretained Compounds

Detector	Analyte
FID	Methane
ECD	Methylene Chloride
NPD	Acetonitrile
TCD, MS	Methane, Butane
PID, ELCD	Vinyl Chloride

Selection of Injection Method

The identification of the most appropriate injection method relies on the sample type and the boiling point to be used in the separation. The diagram below summarizes this selection process:



Column Conditioning (All Columns Except TRACE TR-1MS and TR-WaxMS)

It is recommended that before the column is subjected to any thermal gradients, all oxygen has been removed because the presence of oxygen in the system can shorten the column lifetime. Removal of oxygen can be achieved by purging the columns with oxygen-free carrier gas for a minimum of 20 minutes at 40°C using an approximate head pressure of 100kPa.

Although all Thermo Scientific columns have been pre-conditioned, we recommend that they are conditioned after installation by following these steps:

1. Heat the column from 50°C to the maximum operating temperature at 5°C/min. and hold for one hour. The maximum operating temperatures for all TRACE GC columns are provided below. It is important to stay within the maximum temperature range for the column.
2. Monitor the detector signal during conditioning until a stable baseline is reached. Due to the factory pre-conditioning of the column, this should be achieved in approximately one hour. This duration may be longer in the case of thick films and polar phases.

Maximum Operating Temperatures for TraceGOLD and TRACE GC Columns

Column	Maximum Operating Temperature
TG-1MS	330°C / 350°C
TG-XLBMS	360°C
TG-5MS	330°C / 350°C
TG-SQC	330°C / 350°C
TG-5MS AMINE	300°C / 315°C
TG-5SILMS	330°C / 350°C
TG-5HT	380°C / 400°C
TG-35MS	300°C / 320°C
TG-35MS AMINE	220°C
TG-17MS	300°C / 320°C
TG-1301MS	260°C / 280°C
TG-624	240°C
TG-VRX	260°C
TG-VMS	260°C
TG-1701MS	260°C / 280°C
TG-225MS	240°C
TG-200MS	320°C / 340°C
TG-POLAR	275°C
TG-WaxMS	260°C
TG-WaxMS A	250°C
TG-WaxMS B	220°C
TG-OCP I / TG-OCP II	340°C
TG-OPP I / TG-OPP II	330°C
TG-ALC I / TG-ALC II	260°C
TG-1MT	430°C
TG-5MT	430°C
TG-WaxMT	260°C

Column	Maximum Operating Temperature
TR-1MS	370°C / 380°C
TR-5	340°C / 350°C for films ≤ 1.5µm 280°C / 300°C for films > 1.5µm
TR-5MS	360°C / 370°C for films ≤ 1.5µm 350°C / 360°C for films > 1.5µm
TR-5HT	380°C / 400°C
TR-35MS	360°C / 370°C
TR-1701	280°C / 300°C
TR-50MS	360°C / 370°C
TR-225	230°C / 250°C
TR-Wax	260°C / 280°C for films ≤ 1.0µm 240°C / 260°C for films > 1.0µm
TR-WaxMS	280°C / 300°C
TR-FFAP	240°C / 250°C
TR-SimDist	400°C for films ≤ 1.0µm 370°C for 2.65µm films
TR-V1	280°C / 300°C
TR-FAME	250°C / 260°C
TR-524	240°C / 260°C
TR-525	340°C / 360°C
TR-527	330°C / 350°C
TR-8095	360°C / 370°C
TR-8270	330°C / 350°C
TR-PCB 8MS	330°C / 350°C
TR-Dioxin 5MS	330°C / 350°C
TR-Biodiesel (M)	300°C / 320°C
TR-Biodiesel (F)	280°C / 300°C
TR-Biodiesel (G)	380°C / 400°C
TR-DoA5	330°C / 350°C
TR-DoA35	330°C / 350°C
TR-Pesticide	330°C / 350°C
TR-Pesticide II	330°C / 350°C
TR-Pesticide III	300°C / 320°C
TR-Pesticide IV	300°C / 320°C

Column Conditioning for the TRACE TR-WaxMS and TR-1MS Columns

This procedure will ensure an ultra low bleed for the column's entire lifetime and is only required once. Once performed, future installation of the column need only be followed by a 30-minute hold at the maximum temperature limit.

After installing the column according to the instrument manufacturer's instructions, follow the procedure below.

Steps	TR-WaxMS	TR-1MS
1	Equilibrate the column at 40°C with carrier gas flow for 20 minutes, purging air content.	Equilibrate the column at 40°C with carrier gas flow for 20 minutes, purging air content.
2	Raise the temperature to 100°C at 5°C/min.	Raise the temperature to 100°C at 5°C/min.
3	Hold for 30 minutes.	Hold for 30 minutes.
4	Raise to 150°C at 5°C/min.	Raise to 150°C at 5°C/min.
5	Hold for 30 minutes.	Hold for 30 minutes.
6	Raise to 200°C at 5°C.	Raise to 250°C at 5°C.
7	Hold for 40 minutes.	Hold for 40 minutes.
8	Raise to 250°C at 5°C/min.	Raise to 300°C at 5°C/min.
9	Hold for 40 minutes.	Hold for 40 minutes.
10	Raise to 280°C at 5°C/min.	Raise to 360°C at 5°C/min.
11	Hold for 30 minutes.	Hold for 30 minutes.

Although quite a long procedure, it will result in longer lifetimes and lower bleed for your column.

Performance Recovery

The performance of the column may exhibit signs of deterioration over time as a result of many different causes. Some of these, such as contamination by high boiling or strongly retained compounds, can be cleared by repeating the column-conditioning until a stable baseline is achieved.

Other contamination such as non-volatile compounds, pieces of septa or ferrule metal can result in poor peak shape due to band broadening at the injection step. This can be cured by the removal of a section from the front end of the column. The amount removed is dependent on the degree of contamination, the size of injection and the ID of the column, but generally 50cm should be sufficient. As the efficiency of the column is proportional to the square root of its length, the removal of the front end will not lower the separation effectiveness by the same ratio as 50cm/column length. A last resort in column regeneration is column washing. Column washing uses a pressurized vessel to force solvent through the column in a reverse direction. The selection of the solvent is dependent on the nature of the samples that have been analyzed and therefore the contamination. It is also dependent on the stationary phase. Generally, 2mL of pentane is suitable for non-polar contamination with methanol used for more polar samples.

Notes